

Hard X-ray Photoelectric Polarimeter

Completed Technology Project (2017 - 2022)



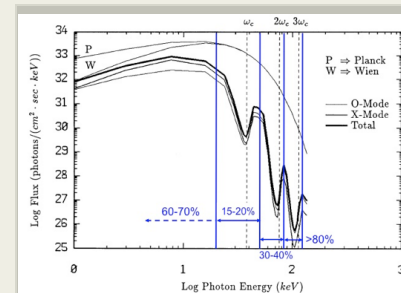
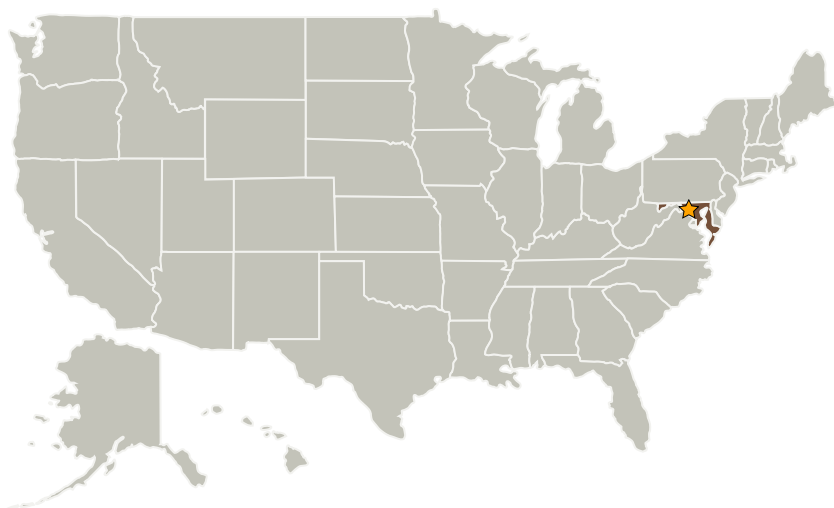
Project Introduction

Our objective is to determine the gas mixtures and pressures that would enable a sensitive, hard X-ray polarimeter using existing flight components with the goal of making astrophysical measurements using the InFOC μ S hard X-ray optics on a long duration balloon flight. Photoelectric allows high sensitivity, low systematics polarization measurements, and photoelectric absorption remains the dominant interaction. The broad outline is to measure the characteristics of mixtures, retrofit detectors for high pressure operation, and prepare for a balloon flight using the InFocus balloon payload to pave the way to a dedicated mission.

Anticipated Benefits

Several groups are developing polarimeters by exploiting the angular and polarization dependence of Compton scattering. Photoelectric polarization appears competitively sensitive as well as simpler (mining the information encoded in the photoelectron track requires measuring only the azimuth of the track whereas taking full advantage of the Compton scattering requires measurement of the azimuth as well as the angle with respect to the incident direction). Simulations show that such a detector has significant sensitivity where the minimum detectable polarization (MDP) can be lower for a 60 hr balloon flight.

Primary U.S. Work Locations and Key Partners



Model X-ray spectrum of Her X-1 showing the cyclotron fundamental (at 35 keV) and the first two harmonics. Spectra for O-mode and X-mode polarization (electric vector parallel and perpendicular to the plane of photon wave-vector...

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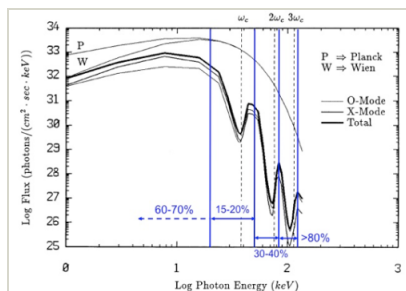


Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Maryland

Images



Hard X-ray Polarimeter Performance

Model X-ray spectrum of Her X-1 showing the cyclotron fundamental (at 35 keV) and the first two harmonics. Spectra for O-mode and X-mode polarization (electric vector parallel and perpendicular to the plane of photon wave-vector and magnetic field)

(<https://techport.nasa.gov/image/100557>)

Links

NASA Goddard Facebook
(<https://www.facebook.com/NASA.GSFC>)

NASA Goddard Science Exploration Directorate
(<http://sciences.gsfc.nasa.gov/sed/>)

NASA Goddard Twitter
(https://twitter.com/intent/follow?screen_name=NASAGoddard)

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Managers:

Keith M Jahoda
David H Richardson

Principal Investigator:

Maurice A Leutenegger

Co-Investigators:

Keith M Jahoda
Joel K Black
Anna Zajczyk
Joanne E Hill-kittle

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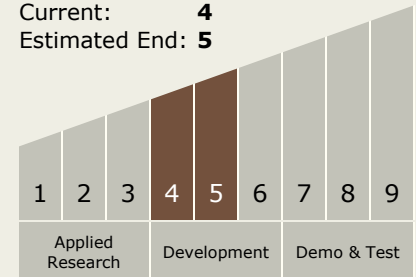


Project Website:

<http://www.nasa.gov/centers/goddard/home/index.html>

Technology Maturity (TRL)

Start: **4**
Current: **4**
Estimated End: **5**



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.1 Detectors and Focal Planes

Target Destination

Others Inside the Solar System